

IN THE CLAIMS:

The text of all pending claims, (including withdrawn claims) is set forth below. Cancelled and not entered claims are indicated with claim number and status only. The claims as listed below show added text with underlining and deleted text with ~~striketrough~~. The status of each claim is indicated with one of (original), (currently amended), (cancelled), (withdrawn), (new), (previously presented), or (not entered).

1. (Previously Presented) A paper edge sensing apparatus in a printer having a pickup unit and a convey unit, the apparatus comprising:
a carrier;
a printer head mounted to the carrier;
a first paper sensor mounted between the pickup unit and the convey unit to detect a top edge and a bottom edge of a paper;
a second paper sensor mounted to the carrier a predetermined distance from the printer head, to detect a right edge, a left edge, the top edge, and the bottom edge of the paper; and
a controller controlling operations of the printer head
to control print margins of top and bottom ends of the paper by comparing first top edge and first bottom edge signals from the first paper sensor and second top edge and second bottom edge signals from the second paper sensor, and
to control print margins of right and left edges of the paper according to left and right edge detections signals of the second paper sensor.

2. (Previously Presented) The apparatus of claim 1, wherein the second paper sensor comprises:
an optical sensor mounted in the carrier and having a light emitter emitting light, a light receiver receiving light, and a reflection surface to reflect light emitted from the light emitter to the light receiver.

3. (Original) The apparatus of claim 2, wherein the reflection surface is transversely arranged across the paper convey direction.

4. (Cancelled)

5. (Previously Presented) The apparatus of claim 1, wherein the predetermined distance is in a range between 0.5 to 1mm.

6. (Cancelled)

7. (Previously Presented) The apparatus of claim 1, wherein the first paper sensor comprises an optical sensor provided with a light emitter emitting light, a light receiver receiving light, and a sensor actuator rotatably mounted to the frame.

8. (Original) The apparatus of claim 1, further comprising:
an encoder detecting a movement amount of the carrier.

9. (Previously Presented) A paper edge sensing method in a printer having a first paper sensor disposed between a pickup unit and a convey unit, and a second paper sensor mounted in a fixed position relative to a moving printer head, comprising:
detecting a top edge and a bottom edge of a sheet of paper using the first paper sensor to output a corresponding first top edge detection signal and a first bottom edge detection signal;
beginning counting a start print time interval and an end print time interval upon detection, by the first paper sensor, of the top and the bottom edge, respectively;
detecting the top edge and the bottom edge of the paper using the second paper sensor to output a corresponding second top edge detection signal and a second bottom edge detection signal;
detecting a left edge or a right edge of the sheet of paper when the second paper sensor moves transversely to at least one of the left edge or the right edge of the sheet of paper; and
generating a begin print command at a later of the start print time interval and the second top edge detection signal, and generating an end print command at a later of the end print time interval and the second bottom edge detection signal.

10. (Cancelled)

11. (Previously Presented) The method of claim 9, wherein the printer comprises a controller and the method further comprises:
transmitting the first and second top edge detection signals and the first and second bottom edge detection signals to the controller;

counting the start print time interval and the end print time interval using the controller;
comparing the start print time interval to the second top edge detection signal and the end
print time interval to the second bottom edge detection signal using the controller; and
controlling operation of the printer head based on a command from the controller.

12. (Original) The method of claim 9, wherein the printer comprises a pickup unit and
a convey unit and further comprising:

controlling dynamic power switching from the pickup unit to the convey unit with the
controller.

13. (Cancelled)

14. (Previously Presented) The method of claim 9, the printer comprising the second
paper sensor and the printer head mounted to a movable carrier, and the method further
comprising:

identifying a first detection signal as either of the first top edge detection signal or the first
bottom edge detection signal if the first detection signal is generated when the carrier is located
at an initial position in a central portion of a width of a sheet.

15. (Previously Presented) The method of claim 9, the printer comprising the second
paper sensor and the printer head mounted to a movable carrier, and the method further
comprising:

identifying a first detection signal as either a first right edge detection signal or a first left
edge detection signal if the first detection signal is generated when the carrier is located outside
of an initial position in a central portion of a width of the sheet.

16. (Original) The method of claim 9, the printer comprising a pickup unit and further
comprising:

picking up the sheet to print thereon.

17. (Original) The method of claim 9, further comprising:

selecting a general print mode to place margins on the sheet.

18. (Original) The method of claim 9, further comprising:

selecting a borderless print mode such that no margins are placed on the sheet.

19. (Previously Presented) The method of claim 9, further comprising:
tracking a position of the second paper sensor.

20. (Original) The method of claim 9, further comprising:
externally discharging an image-printed sheet from the printer.

21. (Previously Presented) The apparatus of claim 1, wherein:
the controller determines a print start timing as a later of:
an estimated timing of the top edge reaching a print position proximate to the
printer head based on the first top edge signal and a speed of the paper moving through the
printer, or
the second top edge signal.

22. (Previously Presented) The apparatus of claim 1, wherein:
the controller determines a print stop timing as a later of:
an estimated timing of the bottom edge moving beyond a range of an upstream
end of the printer head based on the first bottom edge signal and a speed of the paper moving
through the printer, or
the second bottom edge signal.

23. (Previously Presented) The apparatus of claim 1, wherein the controller controls
the printer head to print within the print margin, to achieve a borderless image on the paper.

24. (Previously Presented) A paper edge sensing apparatus for borderless printing in
a printer having a pickup unit, a convey unit, a carrier, and a printer head connected with the
carrier, the apparatus comprising:

a first paper sensor mounted between the pickup unit and the convey unit to detect a top
edge and a bottom edge of a paper;

a second paper sensor connected with the carrier, to detect a right edge, a left edge, the
top edge, and the bottom edge of the paper; and

a controller, using right and left edge signals from the second paper sensor and
comparing first top edge and first bottom edge signals from the first paper sensor and second

top edge and second bottom edge signals from the second paper sensor, to control the printer head to start and stop printing on the paper.

25. (Previously Presented) The apparatus of claim 24, wherein the controller controls the printer head to print on the entire paper, to achieve a borderless image on the paper.

26. (Previously Presented) A paper edge sensing apparatus in a printer, comprising:
a carrier;
a printer head mounted to the carrier;
a first paper sensor mounted between a pickup unit and a convey unit to detect a top edge and a bottom edge of a paper;
a second paper sensor mounted to the carrier a predetermined distance from the printer head and detecting the top edge, the bottom edge, and left and right edges of the paper; and
a controller controlling operations of the printer head according to a comparison of signals from the first and second paper sensors,
wherein a paper print margin comprises the predetermined distance between the second paper sensor and the printer head.

27. (Previously Presented) A paper edge sensing method in a printer having a first paper sensor mounted between a pickup unit and a convey, and a second paper sensor mounted in a fixed position relative to a moving printer head, the method comprising:
detecting a top edge and a bottom edge of a sheet of paper using the first paper sensor, to output a corresponding first top edge detection signal and a first bottom edge detection signal;
detecting a top edge, a bottom edge, and at least one of left or right edges of the sheet of paper using the second paper sensor, to output a corresponding second top edge detection signal, a second bottom edge detection signal, and at least one of left or right edge detection signals;
estimating a start print time based on the first top edge detection signal and generating a begin print command at a later of the estimated start print time and the second top edge detection signal;
estimating an end print time based on the first bottom edge detection signal and generating an end print command at a later of the estimated end print time and the second bottom edge detection signal; and
generating at least one of left or right edge print commands when the at least one of the left or right edges is detected.

28. (Previously Presented) A paper edge sensing apparatus in a printer, comprising:
- a carrier;
 - a printer head mounted to the carrier;
 - a first paper sensor mounted between a pickup unit and a convey unit to detect a top edge and a bottom edge of a paper;
 - a second paper sensor mounted to the carrier a predetermined distance upstream, with respect to a paper traveling direction, from the printer head, and detecting the top edge, the bottom edge, and at least one of left or right edges of the paper; and
 - a controller controlling operations of the printer head according to a comparison of signals from the first and second paper sensors.